

1           1. A method for forming an electrical conductor  
2 with a plurality of electromigration-inhibiting/electrically  
3 conductive plugs disposed between electrically conductive  
4 segments of the electrical conductor, comprising the steps  
5 of:  
6           forming a row of aligned windows in a planar  
7 surface;  
8           depositing an electromigration-  
9 inhibiting/electrically conductive material over the planar  
10 surface and through the windows to fill the windows and  
11 thereby provide, in such windows, plugs of electromigration-  
12 inhibiting/electrically conductive material;  
13           removing portions of the electromigration-  
14 inhibiting/electrically conductive material to form the  
15 plugs with surfaces co-planar with a surface surrounding the  
16 plugs.

1           2. The method recited in claim 1, wherein the  
2 distance between the windows is equal to or less than a  
3 predetermined critical length,  $L_c$ , selected to inhibit  
4 electromigration.

1           3. The method recited in claim 2, wherein the  
2 conductor has a length,  $L$ , and wherein the number of windows  
3 is equal to or more than  $(L/L_c)-1$ .

1           4. The method recited in claim 1 wherein the planar  
2 surface includes an electrically conductive film and wherein  
3 the electromigration-inhibiting/electrically conductive  
4 material is deposited over the conductive film and into the  
5 windows formed therein to provide, in such windows, the  
6 plugs;

7 wherein, subsequently, portions of the deposited  
8 material are removed to form the plugs with surfaces  
9 co-planar with a surface surrounding the plugs; and  
10 wherein the electrically conductive film is  
11 patterned to form the electrically conductive segments  
12 connecting the plugs.

1 5. The method recited in claim 4, wherein the  
2 electrically conductive film is a multi-layer structure  
3 including one or more layers of electromigration-inhibiting  
4 refractory materials.

1 6. The method recited in claim 1 wherein the planar  
2 surface includes a dielectric layer; and  
3 wherein the electromigration-inhibiting/electrically  
4 conductive material is deposited over the dielectric layer  
5 and into the windows formed therein to provide the plugs;  
6 and  
7 removing portions of the deposited electromigration-  
8 inhibiting/electrically conductive material to form the  
9 plugs with a surface co-planar with exposed surface portions  
10 of the dielectric layer surrounding the plugs.

1 7. The method recited in claim 6 including the steps  
2 of:  
3 forming trenches in the surface portions of the  
4 dielectric film abutting and aligned with, the plugs;  
5 depositing an electrically conductive material,  
6 deposited over the dielectric layer and into the trenches;  
7 subsequently removing portions of the deposited  
8 electrically conductive material from the dielectric layer  
9 to form, in each one of the trenches, corresponding  
10 electrically conductive segments with surfaces thereof co-

11 planar with each other, with the surface of the plugs, and  
12 with surfaces of the dielectric layer, and connecting the  
13 plugs.

1 8. The method recited in claim 7 wherein the  
2 electromigration-inhibiting refractory metal liner and  
3 electrically conductive material are deposited successively  
4 into the trenches.

1 9. The method recited in claim 1 wherein the planar  
2 surface includes a dielectric layer having an electrical  
3 conductor disposed therein;

4 wherein the windows are formed in the electrical  
5 conductor thereby separating the electrical conductor into  
6 plurality of electrically conductive segments;

7 wherein the electromigration-inhibiting/electrically  
8 conductive material is deposited over the dielectric layer,  
9 over the electrical conductor and into the windows to  
10 provide, in such windows, the plugs;

11 wherein portions of the deposited electromigration-  
12 inhibiting/electrically conductive material are removed to  
13 form the plugs with surfaces co-planar with a surface of the  
14 dielectric layer and with surfaces of the electrically  
15 conductive segments.

1 10. The method recited in claim 1 wherein an  
2 electromigration-inhibiting/electrically conducting liner  
3 and an electrically conducting material are deposited  
4 successively into the windows.

1 11. The method recited in claim 4 wherein an  
2 electromigration-inhibiting/electrically conducting liner

3 and an electrically conducting material are deposited  
4 successively into the windows.

1 12. The method recited in claim 6 wherein an  
2 electromigration-inhibiting/electrically conducting liner  
3 and an electrically conducting material are deposited  
4 successively into the windows.

1 13. The method recited in claim 9, wherein an  
2 electromigration-inhibiting/electrically conducting liner  
3 and an electrically conducting material are deposited  
4 successively into the windows.

1 14. A method comprising the steps of:  
2 forming a plurality of rows of aligned windows in  
3 the planar surface;  
4 filling the windows with electromigration-  
5 inhibiting/electrically conducting material to form a  
6 plurality of the plugs in the windows, a portion of such  
7 material extending beyond the planar surface;  
8 removing the portion of the said material extending  
9 beyond the planar surface to form the plugs with  
10 electrically conductive segments electrically interconnected  
11 through the plugs.

1 15. A method for forming a multiconductor  
2 metallization system with a distance between conductors less  
3 than one micron comprising the steps of:  
4 forming a plurality of equidistant rows of aligned  
5 windows in the planar surface;  
6 filling the windows with electromigration-  
7 inhibiting/electrically conducting material to form a

8 plurality of the plugs in the windows, a portion of such  
9 material extending beyond the planar surface;  
10 removing the portion of the said material extending  
11 beyond the planar surface to form the plugs with surfaces  
12 co-planar with surfaces surrounding the plugs;  
13 forming electrically conductive segments within the  
14 same planar surface, abutting and electrically  
15 interconnecting the plugs.

1 16. The method recited in claim 15, wherein the  
2 planar surface includes a dielectric layer having an  
3 electrical conductor disposed therein, and where the  
4 electrical conducted segments are formed simultaneously with  
5 the windows.

1 17. A multilevel metallization system, comprising:  
2 a first metallization level of such system  
3 comprising: first electrical conductors having each a  
4 plurality of first electromigration-inhibiting/electrically  
5 conducting plugs therein, the first plugs having co-planar  
6 surfaces, the first electrical conductors comprising each a  
7 plurality of first electrically conductive segments  
8 electrically interconnected through the first plugs, the  
9 first electrically conductive segments being co-planar with  
10 each other and the first plugs;  
11 electrically conductive vias passing through  
12 apertures in a dielectric layer disposed on the first  
13 metallization system to electrically interconnect the first  
14 metallization level and a second metallization level;  
15 such second metallization system comprising:  
16 electrical conductors having each a plurality  
17 of second electrically conductive segments electrically  
18 interconnected through a plurality of second

19 electromigration-inhibiting/electrically conducting plugs,  
20 the second electrically conductive segments and the second  
21 plugs being co-planar.

1 18. A method of forming a multilevel metallization  
2 system, comprising:

3 forming a first metallization level of such system  
4 comprising: first electrical conductors having each a  
5 plurality of first electromigration-inhibiting/electrically  
6 conducting plugs therein, the first plugs having co-planar  
7 surfaces, the first electrical conductors comprising each a  
8 plurality of first electrically conductive segments  
9 electrically interconnected through the first plugs, the  
10 first electrically conductive segments being co-planar with  
11 each other and the first plugs;

12 forming electrically conductive vias passing  
13 through apertures in a dielectric layer disposed on the  
14 first metallization system to electrically interconnect the  
15 first metallization level and a second metallization level;

16 forming such second metallization system comprising:

17 forming electrical conductors having each a  
18 plurality of second electrically conductive segments  
19 electrically interconnected through a plurality of second  
20 electromigration-inhibiting/electrically conducting plugs,  
21 the second electrically conductive segments and the second  
22 plugs being co-planar.

1 19. An electrical conductor, comprising:  
2 a plurality of electrically conductive segments,  
3 a plurality of electromigration-  
4 inhibiting/electrically conductive plugs disposed between  
5 the segments;

6       the electrical conductor has a length,  $L$ , the number  
7 of such plugs being equal to or more than  $(L/L_c)-1$ , where  $L_c$   
8 is a predetermined critical length selected to inhibit  
9 electromigration.

1       20. The electrical conductor recited in claim 19,  
2 wherein  $(R-R_0)/R_0$  is less than 0.01, where  $R$  is the  
3 resistance of the electrical conductor and  $R_0$  is the  
4 resistance of an electrical conductor of equal length and  
5 made of the same material as the electrically conductive  
6 segments without the plugs.

1       21. An electrical conductor comprising:  
2       a plurality of electrically conductive segments;  
3       a plurality of electromigration-inhibiting/  
4 electrically conductive plugs disposed between the segments;  
5       such plugs comprising:  
6       an electromigration-inhibiting/electrically  
7 conductive liner; and,  
8       an electrically conductive material.